

The Making of Potato Chips

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Production of potato chips jumped from 45 million pounds in 1936 to nearly 260 million in 1946. In terms of potatoes utilized as chips, production rose from 3 million to 15 million bushels a year during that period. Consumption in 1949 was about 20 million bushels and the capital investment in the industry was about 25 million dollars.

The industry is of importance to American farmers also as an outlet for domestic vegetable oils. Potato chips owe their relatively high food value chiefly to their carbohydrate and fat content. They contain from 30 to 50 percent fat. Using 40 percent as the average fat content, we figure that the fat used for making chips increased from 13 million pounds in 1936 to about 100 million in 1949.

The steady increase in the production of chips results partly from improvements in machinery, which make it possible to turn out more high-grade chips, and in merchandising (packaging and sales) methods that aid in keeping a fresher and more attractive product before the consumer, and from the increased consumption of manufactured rather than the home-cooked foods.

The processing of potato chips is a fairly routine and easy procedure, but knowledge and experience are necessary to obtain and handle raw stock from which good chips can be made.

For quality the finished product depends largely on the source and variety of the potatoes used. Some varieties, notably Russet Rural, Russet Burbank, Irish Cobbler, and the new Kennebec and Canus, are more suitable than Green Mountain, Bliss Triumph, Pontiac, and some others, which usually cannot be used because the chips from them are often too dark brown.

Storage temperatures are important. When potatoes are kept at a relatively low temperature, too much sugar builds up at the expense of the starch content. A small increase in amount of sugar over that present in tubers at digging turns the chips too dark. Usually during January chip manufacturers begin to have extra trouble in obtaining suitable potatoes because of low temperatures in storages. The potatoes can be desugared, or conditioned, by exposure to a temperature of about 70° F. for 1 to 4 weeks if they are of the right variety and have not been too cold too long.

Potatoes that have been stored at 40° F. for more than 10 days are not likely to be suitable for chipping without first being conditioned. Stock held at 50° can be processed directly without being conditioned, because at that temperature the sugar content remains about the same as when the potatoes were harvested. Furthermore, excessive sprouting will not occur at 50° until 2 to 5 months after digging, depending on the variety. A little sprouting is not harmful—in fact, most chippers prefer stock with some sprouting. Chippers who can control their stock may follow this "magic 50°" program, which will keep them in potatoes for chipping through February and possibly March. If they want stock for late spring or before southern new-crop potatoes are available in good quantities, they can store an additional supply of

potatoes at 40° and condition this stock as needed.

Steps in processing include peeling, slicing, washing the slices, frying, salting, and packaging. Cooking operations may be on a small scale, as in the batch-frying process, in which hand-operated kettles are used. Or, they may be on a large scale, by the mechanized continuous-frying process. It is fascinating to watch the finished chips delivered from the huge cookers, which have a capacity up to 500 pounds an hour. Almost before they are cool the chips are bagged, put in cartons, loaded on motor trucks, and hurried on their way.

In the continuous process, the potatoes first are peeled in abrasive peelers, which grind off the outer surfaces by a whirling motion. Inspection and trimming by hand follow. The use of abrasive peelers often results in definite loss of potato flesh as well as skin, because of uneven action and irregular-shaped potatoes. Other types of peelers, such as those that use steam or direct flame, have possible application as means of reducing the loss.

The peeled potatoes are sliced in rotary slicers. The thickness of the slice varies with each lot and has an important effect on the degree of curl and the ultimate appearance of the chips. The number of slices usually varies from 15 to 20 to the inch. The slices are washed in a mesh cylinder, which rotates in a trough of water. Fins within the cylinder move the slices along as they are tumbled over and over. Washing removes granules of free starch and small bits of potato, which would otherwise char during frying. The slices then move over a mesh conveyor belt to the cooker.

A long, shallow, covered trough, heated from below, contains the frying oil. The slices enter at the hot end of the fryer and are kept submerged in the hot oil as they are moved at a regulated speed to the front end. The large volume of steam and other fumes is exhausted through a flue to the outside. Near each end is a thermometer. The

temperature is held at about 375° F. or a little higher at the hot end and 325° F. at the outlet end. The frying temperature is varied to compensate for the browning tendency inherent in some raw material. Higher temperatures increase browning; lower ones decrease it. The fried chips fall on a mesh conveyor, where they drain before passing under a salt sprinkler and then to the packing room.

Vegetable oils or fats, most commonly cottonseed oil, corn oil, and peanut oil, in either liquid or solid hydrogenated form, serve as the usual frying medium. The kind of oil used is determined by price and also by local preference for certain tastes resulting from the oil in which chips are fried. Recent studies at the Plant Industry Station at Beltsville have shown some differences between varieties of potatoes, but practically none between oils, in the amount taken up in the chips. It was also found that chips from potatoes of high starch content are less oily than chips from potatoes with less starch.

Several methods of treating potatoes at the factory are being tested to determine what characteristics of certain varieties or what handling or storage practices cause the excessive browning that has been so troublesome. Some of them are based on extraction of the browning reactants from the raw slices before frying. Another method of approach being studied at the Western Regional Research Laboratory is based on the dehydration of raw sliced potatoes shortly after harvest and their storage for later use in order to avoid the results of prolonged cool storage of fresh stock.

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